current data block has been completed and begins variable length decoding of a subsequent data block.

19. (Twice Amended) A decoding method as set forth in claim 18, wherein

said data stream comprises a plurality of image data blocks,

and further comprising the steps of, in each of said plurality of signal processing devices,

inverse quantizing the image data blocks to generate quantized data blocks;

performing an inverse transformation on the quantized data blocks to generate transformed data blocks;

obtaining original image data from at least one of the transformed data blocks; and

performing motion compensation processing for said transformed data blocks.

Remarks

Claims 1-19 are pending in this application and have been amended as shown in Appendix A. Claims 1-9, 14-16, and 19 stand rejected under §103(a) as unpatentable over Wantanabe (U.S. Pat. No. 5,675,331). Claims 10-13, 17, and 18 stand rejected under §102(b) as anticipated by Wantanabe. The Applicants respectfully traverse these rejections.

Independent claims 1 and 7 are directed to an apparatus and method, respectively, for encoding image data (e.g., according to the MPEG-2 standard). Similarly, independent claims 10 and 17 are directed to an apparatus and method, respectively, for decoding image data (e.g., MPEG-2 coded data). The independent

claims share in common that the coding and decoding operations are performed in parallel on multiple processors.

For example, claim 1 recites that the encoding apparatus comprises a multiprocessor system in which individual signal processing devices perform both fixed length and variable length coding. In particular, as claimed, the signal processing devices each include a fixed length coding means and a variable length coding means for executing a fixed length coding operation followed by a variable length coding operation. As claimed, the signal processing devices are assigned the coding of either macroblocks or slices. (Specification, pages 22-26, 29-30, 35-41, Figures 12, 18). Claim 10 recites parallel limitations for the decoding apparatus. (Specification, pages 2-35, 42-48, Figures 15, 21). In other words, encoding runs in parallel between signal processing devices, and, inside each signal processing device, both fixed and variable length coding occurs.

In a manner similar to that of claims 1 and 10, the independent method claims recite processing slices or marcoblocks in parallel on multiple processors. For example, claim 7 recites allotting data blocks to individually assigned signal processing devices, and, in parallel, encoding the data blocks. Claim 17 recites parallel limitations for the decoding method.

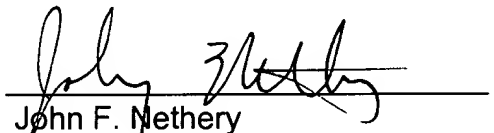
Turning to the rejections, Wantanabe is directed to a decoding device. The decoding device includes a variable length coder and a fixed length coder. However, Wantanabe does not teach or suggest that, as claimed, macroblocks or slices as a whole are distributed between multiple processing devices. As a result, Wantanabe also does not teach or suggest that the processing devices perform both fixed and variable length coding or decoding in parallel with the remaining processing devices. In

other words, a sequence of macroblocks or slices have to be processed by Wantanabe sequentially, while the claimed invention provides for parallel processing of multiple blocks or slices, and an associated increase in processing speed.

Conclusion

For the forgoing reasons, it is respectfully submitted that the proposed amendments place the pending claims in condition for allowance. Entry of the amendments is therefore requested. Should anything remain in order to place the present application in condition for allowance, the Examiner is kindly invited to contact the undersigned at the telephone number listed below.

Respectfully submitted,



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APPENDIX A
VERSION WITH MARKINGS TO SHOW CHANGES MADE IN CLAIMS

1. (Twice Amended) An encoding apparatus for [encoding a data stream comprising a plurality of data blocks] producing encoded data blocks, the encoding apparatus comprising a multiprocessor system comprising:

a plurality of signal processing devices connected by a signal transfer means on which said data blocks are transferred, wherein

each data block is one of a macroblock or a slice,

and wherein a first assigned data block assigned to a first processing device in the plurality of processing devices is produced in parallel with a second assigned data block assigned to a second processing device in the plurality of processing devices,

and wherein the first processing device and the second processing device include a fixed length coding means for producing fixed length coded data and a variable length coding means for subsequently variable length coding the fixed length coded data as steps in producing the coded data blocks.

[each signal processing device comprising:

an fixed length encoding means for carrying out a fixed length coding of selected data blocks to produce encoded data blocks; and

a variable length coding means for carrying out a variable length coding of said encoded data blocks and outputting variable length coded data blocks via said signal transfer means; and wherein

said plurality of signal processing devices includes a master processor and a slave processor for executing in parallel the fixed length coding and the variable length coding.]

3. (Twice Amended) An encoding apparatus as set forth in claim 2, wherein:

[said data stream comprises image data,]

each of said fixed length encoding means of said plurality of signal processing devices carries out said fixed length encoding for each image slice data block comprising an image slice, and

each of said variable length coding means of said plurality of signal processing devices carries out variable length coding on each image slice data block.

7. (Twice Amended) An encoding method for encoding a data stream, the method comprising:

dividing said data stream into a plurality of data blocks, each data block comprising one of a macroblock and an image slice;

successively allotting said data blocks to individually assigned signal processing devices in a plurality of signal processing devices;

encoding said data blocks in parallel in each of said individually assigned signal processing devices to produce encoded data blocks;

successively carrying out variable length coding [on] for the encoded data blocks in its individually [assigned] allotted signal processing device; and

successively allotting additional data blocks to the signal processing devices that have completed variable length coding.

10. (Twice Amended) A decoding apparatus for decoding a data stream comprising a plurality of data blocks [including fixed and variable length coded data blocks], the decoding apparatus comprising:

a multiprocessor system comprising a plurality of signal processing devices, wherein

each data block comprises a macroblock or a slice,

and wherein a first assigned data block assigned to a first processing device in the plurality of processing devices is decoded in parallel with a second assigned data block assigned to a second processing device in the plurality of processing devices,

and wherein the first processing device and the second processing device include a fixed length decoding means for producing fixed length coded data and a variable length decoding means for subsequently variable length coding the fixed length coded data as steps in decoding the coded data blocks.

[each of the signal processing devices comprising:

a variable length decoding means for successively carrying out variable length decoding on variable length coded data blocks to obtain fixed length encoded data blocks; and

a fixed length decoding means for fixed length decoding said fixed length encoded data blocks, wherein

said plurality of signal processing devices includes a master processor and a slave processor for executing in parallel the fixed length decoding and the variable length decoding.]

11. (Twice Amended) A decoding apparatus as set forth in claim 10, wherein each of said variable length decoding means of said plurality of signal processing devices detects completion of the variable length decoding of a current data block and starts variable length decoding of a subsequent data block.

12. (Twice Amended) A decoding apparatus as set forth in claim 11, further comprising an allotting means for sequentially allotting the [variable length coded] data blocks to said plurality of signal processing devices, and

wherein each of the signal processing devices performs both the variable length decoding and the fixed length decoding of [a] each data block allotted to it.

13. (Twice Amended) A decoding apparatus as set forth in claim 11, wherein

said data stream is a variable length coded image data stream obtained by fixed length and variable length encoding of image data blocks and wherein each of the signal processing devices performs both the variable length decoding and the fixed length decoding of [a] each data block allotted to it.

17. (Twice Amended) A decoding method for decoding a data stream comprising a plurality of data blocks [including fixed and variable length coded data blocks], the method comprising:

successively allotting [variable length coded] data blocks to a plurality of signal processing devices;

wherein each data block is one of a macroblock or a slice;

in each signal processing device, carrying out both variable length decoding on an assigned data block followed by fixed length decoding of said assigned data block,

wherein the signal processing devices perform the variable length decoding and fixed length decoding of assigned data blocks in parallel.

18. (Twice Amended) A decoding method as set forth in claim 17, wherein each of said plurality of signal processing devices detects when variable length decoding for a current data block has been completed and begins variable length decoding of a subsequent data block.

19. (Twice Amended) A decoding method as set forth in claim 18, wherein

said data stream comprises a plurality of image data blocks,

and further comprising the steps of, in each of said plurality of signal processing devices,

inverse quantizing the image data blocks to generate quantized data blocks;

performing an inverse transformation on the quantized data blocks to generate transformed data blocks;

obtaining original image data from at least one of the transformed data blocks[.]; and

performing motion compensation processing for said transformed data blocks[;].